



{In Archive} Re: West Lake Landfill: Region 7 DRAFT feedback on Batch 3 SFS RTCs

Stuart Walker to: Rich Kapuscinski

07/01/2011 06:33 PM

Cc: Dan Gravatt, Doug Ammon, Audrey Asher, DeAndre Singletary,
Matthew Jefferson, David Bartenfelder, Ron Wilhelm

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A comment



Section 2 - Site Conditions_April26_OSRTIComments_stuart.docx

Rich Kapuscinski

I have incorporated some suggested edits to thr...

06/23/2011 11:51:13 AM

From: Rich Kapuscinski/DC/USEPA/US
To: Dan Gravatt/R7/USEPA/US@EPA
Cc: Doug Ammon/DC/USEPA/US@EPA, Audrey Asher/R7/USEPA/US@EPA, DeAndre Singletary/SUPR/R7/USEPA/US@EPA, Matthew Jefferson/R7/USEPA/US@EPA, Stuart Walker/DC/USEPA/US@EPA, David Bartenfelder/DC/USEPA/US@EPA, Ron Wilhelm/DC/USEPA/US@EPA
Date: 06/23/2011 11:51 AM
Subject: Re: West Lake Landfill: Region 7 DRAFT feedback on Batch 3 SFS RTCs

I have incorporated some suggested edits to three of the responses to reflect that, in fact, we have edits to the PRPs' draft Sections 1-3, whereas the proposed draft responses suggest that we accept their drafts of Sections 1 and 2 as submitted and does not reflect that the PRPs revised Section 3 further after our meeting in mid-May. I am also attaching an updated Section 2, which incorporates one additional comment on page 15 that I received after the previous submittal.

Rich Kapuscinski

[attachment "Responses re Report Organization & Introduction EPA Addl 11, 12, 13, 26 & 38 EPA feedback_OSRTIedits.doc" deleted by Stuart Walker/DC/USEPA/US] [attachment "Responses EPA Addl 5, 6, 10, 17, 21, 28 & 29 and MDNR 15, 16, 17, 88 & 116 - Site Conditions EPA feedback_OSRTIedits.docx" deleted by Stuart Walker/DC/USEPA/US] [attachment "Section 2 - Site Conditions_April26_OSRTIComments.docx" deleted by Stuart Walker/DC/USEPA/US] [attachment "Responses to RIM Characterization Comments EPA feedback_OSRTIedits.docx" deleted by Stuart Walker/DC/USEPA/US]

Dan Gravatt

Rich, The draft R7 feedbacks on the Batch 3 RT...

06/21/2011 04:15:44 PM

From: Dan Gravatt/R7/USEPA/US
To: Rich Kapuscinski/DC/USEPA/US@EPA
Cc: Doug Ammon/DC/USEPA/US@EPA, Audrey Asher/R7/USEPA/US@EPA, DeAndre Singletary/SUPR/R7/USEPA/US@EPA, Matthew Jefferson/R7/USEPA/US@EPA
Date: 06/21/2011 04:15 PM
Subject: Re: West Lake Landfill: Region 7 DRAFT feedback on Batch 3 SFS RTCs

Rich,

The draft R7 feedbacks on the Batch 3 RTCs I previously sent you (attached below) have not changed since they were sent, so they represent R7's latest proposed feedback on these RTCs.

Daniel R. Gravatt, PG

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Superfund

0001

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Principles and integrity are expensive, but they are among the very few things worth having.

Rich Kapuscinski	For purposes of soliciting final review from my O...	06/21/2011 01:29:25 PM
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From: Rich Kapuscinski/DC/USEPA/US
To: Dan Gravatt/R7/USEPA/US@EPA
Cc: Doug Ammon/DC/USEPA/US@EPA
Date: 06/21/2011 01:29 PM
Subject: Re: West Lake Landfill: Region 7 DRAFT feedback on Batch 3 SFS RTCs

For purposes of soliciting final review from my OSRTI and ORIA colleagues, does this set of drafts incorporate Region 7's latest proposals for the respective responses to the PRPs? If not, could you please provide same?

Thanks for your time and consideration.

Rich Kapuscinski

Dan Gravatt	Rich, As you requested in this afternoon's updat...	05/10/2011 03:39:11 PM
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From: Dan Gravatt/R7/USEPA/US
To: Rich Kapuscinski/DC/USEPA/US@EPA
Cc: Doug Ammon/DC/USEPA/US@EPA
Date: 05/10/2011 03:39 PM
Subject: West Lake Landfill: Region 7 DRAFT feedback on Batch 3 SFS RTCs

Rich,
As you requested in this afternoon's update call, here is my DRAFT feedback on all the Batch 3 RTCs:

[attachment "Responses to RIM Characterization Comments EPA feedback.docx" deleted by Rich Kapuscinski/DC/USEPA/US] [attachment "Section 3 - RIM Characterization EPA feedback.doc" deleted by Rich Kapuscinski/DC/USEPA/US] [attachment "Responses EPA Addl 5, 6, 10, 17, 21, 28 & 29 and MDNR 15, 16, 17, 88 & 116 - Site Conditions EPA feedback.docx" deleted by Rich Kapuscinski/DC/USEPA/US] [attachment "Responses re Report Organization & Introduction EPA Addl 11, 12, 13, 26 & 38 EPA feedback.doc" deleted by Rich Kapuscinski/DC/USEPA/US] [attachment "Alternative Evaluation Criteria EPA feedback.doc" deleted by Rich Kapuscinski/DC/USEPA/US] [attachment "EPA 15 and 38 - Waste Acceptance and Offsite Rule EPA feedback.doc" deleted by Rich Kapuscinski/DC/USEPA/US] [attachment "Responses to EPA 17, EPA Addl 33 & 46 and MDNR 53 RE solids separation EPA feedback.doc" deleted by Rich Kapuscinski/DC/USEPA/US] [attachment "Response to EPA 23 RE Onsite Cell Cover Design EPA feedback.doc" deleted by Rich Kapuscinski/DC/USEPA/US] [attachment "On-Site Cell Capacity - EPA Sp 42 and MDNR 54 & 63 4-7-11 EPA feedback.doc" deleted by Rich Kapuscinski/DC/USEPA/US] [attachment "EPA Specific Comment 55 - Waste Settlement EPA feedback.doc" deleted by Rich Kapuscinski/DC/USEPA/US] [attachment "Long Term OMM Costs - MDNR 47 48 74 76 and 91 EPA feedback.doc" deleted by Rich Kapuscinski/DC/USEPA/US]

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2 **SITE** CONDITIONS

The purpose of this section is to support the evaluation of remedial technologies and alternatives that is provided herein in Sections 4, 7 and 8. Towards that end, this section summarizes and recapitulates for convenience certain site-specific information from the existing Administrative Record and provides expanded discussions of: the current uses and existing use restrictions for the Site, the Missouri River floodplain and existing flood control structures; and seismic conditions.

This section presents a summary of the surface and subsurface conditions at the West Lake Landfill based on the results of the RI evaluations (EMSI, 2000). This section also presents a conceptual model of the occurrence of radiologically impacted materials (RIM) and the potential pathways through which radionuclides have or could migrate from Areas 1 and 2 in the absence of remedial action. A summary of the Baseline Risk Assessment (BRA) (Auxier & Associates, 2000) assessment of potential risks posed by both the radionuclides and the non-radiological parameters present in, and potentially migrating from, Areas 1 and 2 is also provided in this section.

2.1 Surface Conditions

The West Lake Landfill is located within the western portion of the St. Louis metropolitan area on the east side of the Missouri River (Figure 1). The landfill is located approximately one mile north of the intersection of Interstate 70 and Interstate 270 within the city limits of the City of Bridgeton in northwestern St. Louis County. The site is situated on the eastern edge of the Missouri River floodplain approximately two miles east of the river (Figure 2).

The site is bounded to the east and northeast by St. Charles Rock Road (State Highway 115). Commercial and industrial properties bound the site on the north, on the other side of St. Charles Rock Road, and to the south. The site is bounded on the west by the Earth City Industrial Park (Earth City) stormwater/flood control pond. The Earth City commercial and industrial complex continues to the west of the stormwater/flood control pond and extends from the site to the Missouri River. The Earth City complex is separated from the river by an engineered levee system owned and maintained by the Earth City Flood Control District.

2.1.1 Site Features and Historic Landfill Operations

The West Lake Landfill is an approximately 200-acre parcel containing multiple areas of past operations. The site was used agriculturally until a limestone quarrying and crushing operation began in 1939. The quarrying operation continued until 1988 and resulted in two quarry pits, the North Quarry Pit and the South Quarry Pit, which were excavated to maximum depth of 240 ft below ground surface (bgs) (Herst & Associates, 2000).

Comment [KR1]: The April 26 "redline" version was used by OSRTI for review and editing. All prior changes were accepted as is, before implementing Track Changes to record OSRTI-suggested edits. Many of the suggested edits pertain to content and organization. A thorough review and detailed editing are warranted once the organization and content are suitable.

Comment [KR2]: This or similar context should be explicitly stated to help the reader understand why some information is repeated herein, whereas other information is not.

Comment [KR3]: Draft Section 2.3 provides a recitation of chemicals detected and locations with maximum concentrations, but not (as claimed here) a conceptual site model. A narrative summary of the site conceptual model would be more useful than the existing recitation for purposes of supporting and understanding the remedial action objectives.

Deleted: Detailed information on the nature and extent of occurrences of radiologically impacted materials in Areas 1 and 2 is presented in the next section (Section 3) of this report.

Comment [KR4]: It is not apparent that the addition of 'Surface Conditions' and 'Subsurface Conditions' as headers is an improvement or is useful for purposes of conveying the content and organization of this Section to any reader. Nor does this draft implement the proposed categories well. For example, information about the materials disposed (within the subsurface) of Areas 1 and 2 appears in the section about Surface Conditions. Information about existing institutional controls and easements also appears in the section about Surface Conditions, although the easements and controls pertain to the sub-surface also. Information about nature and extent of contamination appears in neither 'Surface Conditions' nor 'Subsurface Conditions.'

Comment [KR5]: The distinction between and intended allocation of information between Site Operations (Section 2.1.1) and Site uses (original Section 2.1.2) are unclear.

The West Lake Landfill is the site of several areas where solid wastes have been disposed. Beginning in the early 1950s or perhaps the later 1940s, portions of the quarried areas and adjacent areas were used for landfilling municipal refuse, industrial solid wastes, and construction/demolition debris. These operations predated state laws and regulations regulating such operations. Landfill activities conducted after 1974 within the quarry areas were subject to a permit obtained from the MDNR. Also In 1974, landfilling began in the portion of the Site described as the North Quarry Pit. Landfilling continued in this area until 1985 when the landfill underwent expansion to the southwest in the area described as the South Quarry Pit (Herst & Associates, 2000). In August 2005, the Bridgeton Sanitary Landfill stopped receiving waste pursuant to an agreement with the City of St. Louis to reduce the potential for birds to interfere with airport operations. The Bridgeton Sanitary Landfill has since been closed pursuant to its permit and is in post-closure status.

The West Lake Landfill property consists of several areas where solid wastes were previously disposed (Figure 3) including:

- Area 1 where solid wastes and radiologically-impacted materials were disposed of in the early 1970s;
- Area 2 where solid wastes and radiologically-impacted materials were disposed of in the early 1970s;
- A closed demolition landfill;
- An inactive sanitary landfill; and
- The former active sanitary landfill located in the North and South Quarry Pits.

2.1.2 Superfund Operable Units

Remedial action at the Site is divided into two operable units (OUs). OU-1 is comprised by the solid wastes and RIM disposed of in Areas 1 and 2 and portions of an adjacent property, formerly described as the Ford Property, now called the Buffer Zone/Crossroad Property. OU-2 addresses the inactive sanitary landfill located adjacent to Area 2. The closed demolition landfill and the former active sanitary waste landfill are regulated by the MDNR pursuant to State of Missouri solid waste regulations and are not part of either OU.

Area 1 is situated on the north and western slopes of a topographic high within the landfill. Ground surface elevation in Area 1 varies from 490 feet above mean sea level ("AMSL") on the south to 452 feet AMSL at the roadway near the landfill property entrance. Area 2 is situated between a topographic high of landfilled materials on the south and east and the Buffer Zone and Crossroad properties (former Ford property) on the west. The highest topographic level in Area 2 is about 500 feet on the southwest side of Area 2 sloping to approximately 470 feet near the top of the landfill berm. The upper surface of the berm along the western edge of Area 2 is located approximately 20 to 30 feet above the adjacent Buffer Zone and Crossroad Property and approximately 30 to 40 feet higher than the water surface in the flood control channel located to the southeast of Area 2. A berm on the northern portions of Area 2 controls runoff to the adjacent properties.

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Deleted: a State landfill permit was obtained and

Deleted: Landfill activities conducted after 1974 within the quarry area were subject to a permit from the MDNR.

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Comment [KR6]: Is it true, as suggested by this bullet and the following bullet, that Areas 1 and 2 received solid wastes only during the 1970s? If not, then please correct and clarify the disposal periods for these two areas.

Deleted: includes

Comment [KR7]: The inserted phrase is intended to reconcile this description of OU1 with the description in the ROD.

Comment [KR8]: This sentence should be reconciled with previous authoritative descriptions of OU2. For example, the OU2 ROD defines OU2 as "the other landfill areas that are not impacted by radionuclide contaminants" [note plural].

Comment [KR9]: Whether in this Section or in proposed new Section 2.1.4 (Current Site Operations), the remedial actions for the non-NPL units (e.g., groundwater or leachate extraction) should be identified, as they may have a bearing on other discussions in the SFS (e.g., on-site groundwater flow conditions).

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No reports, drawings or other records exist regarding the construction of or wastes disposed in the Area 1 and Area 2 landfills. Based on the RI investigations, it appears that these areas were filled using an "area-fill" approach whereby waste materials consisting primarily of municipal solid wastes, construction and demolition debris, and quarry spoil material were deposited onto the existing land surface. Reportedly, 43,000 tons of waste and soil containing 8,700 tons of leached barium-sulfate residue were disposed of in Areas 1 and 2. No records exist regarding the locations or manner in which these materials were disposed in Areas 1 and 2.

Comment [KR10]: This Section should characterize the depth of waste material in Areas 1 and 2, if known or estimable based upon the RI data or other evidence.

The soil boring logs developed during the RI describe the landfill debris in Areas 1 and 2 as consisting variably of wood, plastic, glass, wire, cloth, rope, paper, yard waste, brick, carpeting, rubber, metal, cardboard, shingles, insulation, concrete, shredded tires, crushed rock, and limestone. No percentages of the relative amounts of these materials is provided and, given the generalized nature of the descriptions of the wastes, there is no indication that the descriptions provided should be construed as being all-inclusive. The soil boring logs also indicate that the landfill debris contains soil but do not contain any information regarding the relative proportions of soil to waste, the types of soil encountered in each of the borings, or the depth intervals where the soil material was encountered, other than a notation when the occurrences of soil material contained within the landfill debris were coincident with the overall depth intervals of the landfill debris.

Comment [KR11]: Is it true, as suggested by this sentence, that a total of 43,000 tons of waste were disposed in Areas 1 and 2? If so, then the radioactive soil would constitute a substantial portion of the total waste volume. If not, then this sentence should be edited appropriately for accuracy.

Deleted: Soil borings drilled during the RI did not identify areas or depth intervals containing only or predominantly soil materials.

On the north side of Area 2 is the property referred to in the RI as the Ford Property. This property was previously owned by Ford Motor Credit, Inc. Prior to 1998, Ford subdivided and sold all of its property in this area. The majority of the Ford property was sold to Crossroad Properties LLC and has been developed into the Crossroad Industrial Park. Crossroad has developed all of their property with the exception of Lot 2A2, a 3.58 acre parcel located immediately north of the Buffer Zone. Ford retained the 1.78 acres immediately adjacent to the western portion of the northern boundary of Area 2, referred to as the Buffer Zone, the ownership of which was subsequently acquired by Rock Road Industries, Inc. (Rock Road) on behalf of the Respondents.

Deleted: Additional discussion regarding the nature and extent of occurrences of radiologically-impacted material within Areas 1 and 2 is presented in Section 3 of this report.

2.1.3 Surrounding Land Uses

The West Lake Landfill is located in a predominantly industrial area. The entire landfill area, including the areas investigated under OU-1 and OU-2, has been the site of historic quarry operations to remove limestone, and landfill operations. Other activities on the OU-2 portion of the property include a solid waste transfer facility, concrete and asphalt batch plant operations, and an auto repair facility (Figure 3).

Comment [KR12]: The SFS should provide an explanation, preferably in Section 2, for the presence of radionuclides on the Ford property, which is not identified in Section 2.1.1 as a disposal area or landfill.

Comment [KR13]: Uses of the Site versus uses of surrounding sites would be more clearly presented in separate sections, whereas the draft of a combined section alternates between these topics. The highlighted portion of the next two paragraphs pertains to on-site uses

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The land use zoning for the West Lake Landfill and adjacent properties is shown on Figure 8. The southern portion of the West Lake Landfill is zoned M-1 (manufacturing district, limited). Although the northern portion of the West Lake Landfill is zoned R-1 (one family dwelling district), this area has never been used for residential purposes, is bounded on all sides by industrial and commercial uses, and has been used for industrial purposes for more than fifty years. In addition, the Missouri Court of Appeals affirmed in a trial court's finding that the

"residential" zoning of the West Lake Quarry property directly south of the West Lake Landfill was unconstitutional, unreasonable and arbitrary. *West Lake Quarry and Material Company v. City of Bridgeton*, 761 S.W. 2d 749 (Mo App 1988). The court specifically considered commercial-industrial land uses of the surrounding property, the high development costs for residential, noise from airplanes, and other evidence and concluded that property in this area is "totally inappropriate for residential development" and ordered the City to rezone the property M-2 (commercial-industrial) [Id. at 752]. Even though a portion of the Site is zoned residential, as a practical matter, the only reasonable future use of the Site is commercial-industrial, not residential. Further, as discussed in detail below, residential use of the Site is prohibited by restrictive covenants.

Land use in the area surrounding the landfill is commercial and industrial. The property to the north of the landfill, across St. Charles Rock Road, is moderately developed with commercial, retail and manufacturing operations. The Earth City industrial park is located adjacent to the landfill on the south and west, across Old St. Charles Rock Road.

Two residential communities are present within approximately one mile of the Site. A trailer park is located to the east of St. Charles Rock Road near Interstate 270 (Figure 2) approximately two-thirds of a mile to the southeast of Area 1 and over a mile to the southeast of Area 2. In addition, The "Spanish Village" neighborhood which contains mixed single and multi-family residential units as well as commercial and industrial facilities is located to the south of the landfill near the intersection of St. Charles Rock Road and I-270, approximately ¾ mile from Area 1 and over one mile from Area 2.

2.1.4 Current Site Uses, Zoning, Use Restrictions, and Easements

The site is located northwest of the Lambert-St. Louis International Airport. Much of the site, including much of Area 1, is located within 10,000 ft of the end of Runway 12W for which construction was completed in 2006 (Figure 9A and 9B [add airport layout figure from Lambert website]). An agreement was reached between the St. Louis Airport Authority (SLAA) and Bridgeton Landfill, LLC whereby the landfill ceased accepting waste in 2005 in order to reduce potential bird impacts to aircraft operations. A fully-enclosed waste transfer facility was constructed at the site to allow delivery of waste materials by collection trucks and transfer of these wastes to packer trucks which then transport the wastes to other disposal facilities.

Various restrictions on land use have been implemented at the site. These restrictions were developed and implemented to reflect: (1) use of the site as a solid waste disposal facility, (2) the presence of radiologically-impacted materials in Areas 1 and 2, and (3) the proximity of the site to the Lambert-St. Louis International Airport. Specifically, residential land use and groundwater use have been prohibited at the West Lake Landfill by restrictive covenants recorded by each of the property owners against their respective parcels (Figure 10). Additional land use covenants have been recorded against Areas 1 and 2 to prevent construction of buildings or utility excavations in these areas.

Comment [KR14]: The proposed inserts are intended to make the paragraph clearer, but should be verified by Region 7 staff for accuracy and completeness.

Deleted: The nearest residential land uses include

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Comment [KR15]: EPA previously suggested the SFS provide in Section 2 additional information about the nature and location of current on-site operations (e.g., to support an explanation regarding why a solid waste transfer station and borrow area are essential to current site operations). EPA also previously suggested that this Section identify undeveloped areas of the Site to provide a foundation for the subsequent discussion of candidate locations for a newly constructed on-site disposal unit as envisioned in one of the excavation alternatives. No such information appears in this draft, but should. This information could be provided in suggested Section 2.1.4.

The existing institutional controls consist of a covenant implemented and recorded in June 1997 against the deeds for the entire landfill prohibiting residential use and groundwater use. An additional covenant was recorded in January 1998 restricting construction of buildings and underground utilities and pipes within Areas 1 and 2. These covenants automatically renew fifty years from the date first recorded and every twenty five years thereafter. The covenants grant EPA, the MDNR, and the owners the right to enforce the covenants' restrictions and these restrictions cannot be terminated without the written approval of the current owners, MDNR and EPA. Copies of these land use covenants are included in Appendix B to this report.

In August 2005, the Bridgeton Sanitary Landfill stopped receiving waste pursuant to an agreement with the City of St. Louis (the airport owner) to reduce the potential for birds to interfere with airport operations. As part of this closure, a Negative Easement and Declaration of Restrictive Covenants Agreement (restrictive covenant) (Appendix B) was recorded against the majority of the West Lake Landfill site, including Areas 1 and 2. Additional discussion of the specific restrictions and requirements of the Negative Easement is presented at the end of Section 4 of this SFS report.

Comment [KR16]: The main text should include a figure showing the extent of the easement, on-site locations subject to current uses, and undeveloped areas of the Site.

2.1.5 Missouri River Floodplain

Portions of the West Lake Landfill, including all of Area 2 and much of Area 1, are located within the geomorphic floodplain of the Missouri River. The topography of the West Lake Landfill area has been significantly altered by quarry activities in the eastern portion of the landfill, and by placement of quarry spoils and landfill materials in the eastern and western portions of the landfill. Consequently, although portions of the landfill were built over the historic (geomorphic) floodplain, development of the landfill property has significantly increased the topographic elevation of much of the landfill such that the majority of the landfill surface is now located above and outside of the 500-year floodplain of the Missouri River.

The Earth City Flood Control and Levee District has constructed and operates and maintains a levee and stormwater management system in order to protect the Earth City development from flooding by the Missouri River from floods with a recurrence interval greater than 500-years (commonly referred to as a 500-year flood). As the Earth City levee is located between the Missouri River and the West Lake Landfill, this levee system also acts to protect the landfill from a 500-year flood.

The limits of the geomorphic floodplain were delineated based on information obtained from the Missouri Department of Natural Resource (MDNR) web site (<http://www.dnr.mo.gov/geology/statemap/stlouis/sl8615.htm>). Specifically, available documentation and mapping pertaining to the West Lake Landfill site and the underlying bedrock and associated geomorphological setting were reviewed to evaluate the potential limits of the historical Missouri River floodplain in the area of the site.

Identification of the geomorphic floodplain was performed by reviewing a 1954 aerial photograph and an unpublished Missouri Department of Natural Resources – Division of

Geology and Land Survey geologic map of the St. Charles Missouri quadrangle which includes the site and surrounding area. MDNR – Division of Geology and Land Survey publication Order Number SL8615 (Figure 4) is a 1986 publication that used a 1954 USGS 7.5 minute topographic quadrangle for a base map in order to portray the bedrock geology in the area. These documents were reviewed to identify the location of the bluffs and terrace alluvium deposits that defined the pre-development, geomorphic floodplain prior to the time the topography of site and surrounding area were modified by quarrying, landfilling, and commercial/industrial development. From this information, the Missouri River alluvial valley deposits (Qal), terrace deposits (Qt), and consolidated bedrock formations were located and used to delineate the historical extent of the floodplain.

The results of this evaluation are presented on Figure 5. Review of this figure indicates that historic geomorphic floodplain originally was located within the north-western portion of the West Lake Landfill property. As a result of prior site development, grading and filling much of the West Lake Landfill property (including all of Area 1 and most of Area 2), now is located at elevations above the current 500-year floodplain which is protected by the Earth City engineered levee and flood control system. Previous to this development activity, however, the majority of the West Lake Landfill property was once located within the geomorphic floodplain.

The Federal Emergency Management Agency (FEMA) prepares Flood Insurance Rate Maps (FIRM) for many portions of the country. These maps are available online through FEMA's Map Service Center site: <http://msc.fema.gov>. The area of the West Lake Landfill is on FIRM Number 29189C0039 H dated August 2, 1995 (FEMA, 1995) This map incorrectly (see discussion below) indicates that Area 2 and the northern portion of Area 1 are in the Zone X flood area (Figure 6). The Zone X Flood Area designation indicates an area of 500-year flood—that is, an area protected from a 100-year flood by levees, but still vulnerable to a 500-year flood. Both adjacent FIRM 29189C0038H and the USGS 24,000:1 Quadrangle map for the area depict a levee along the east-southeast bank of the Missouri River, running from approximately River Miles 27-30. Zone X Flood Areas do not have base flood elevations established. However, should the river stage rise above the elevation corresponding to the top of the protective levee, the Zone X Flood Area would be inundated.

The FIRM reflects the fact that at one time the surface elevation of Areas 1 and 2 were below the 100 year high water levels. Landfilling in this area has significantly raised the elevation of Areas 1 and 2 above the level of the floodplain. Specifically, according to the FIRM for this area, in the event of a 100 year flood, the water elevation would rise to between 453 to 454 feet within the levee system along the river (FIRM, St. Louis County, Panels 38 and 39, effective date August 2, 1995).

It should be noted that the published FIRM map contains an inaccuracy that was acknowledged by FEMA through a Letter of Map Revisions (LoMR) dated March 5, 1996. According to the LoMR, the levee that protects the Earth City area, including the West Lake Landfill, is protective of a 500-year flood, not just a 100-year flood. The FIRM 29189C0039H does not reflect the protection afforded by the nearby Earth City Levee System. FEMA's LoMR acknowledged the error and proposed changes to the affected FIRMs, but the FIRMs themselves have not yet been formally updated. The LoMR indicates that the proposed FIRM revisions reflect the 500-year

Site Conditions

4/15/2011

Page 6

flood protection afforded by the Earth City Levee. The Zone X Flood Area that includes the West Lake Landfill is annotated on the proposed revisions with the following text: "This area protected from the 0.2-percent annual chance (500-year) flood by levee, dike, or other structures subject to possible failure or overtopping during larger floods."

Finally, the surface of the Area 2 berm is approximately 20 feet above the projected 100-year flood elevations within the levee system along the river. Flooding of areas adjacent to the landfill (i.e., areas outside of the levee system) would only occur as a result of a failure of the levee system. Spreading of floodwaters into areas outside of the levee system would result in lower flood elevations than those projected to occur within the levee system. Therefore, the actual elevations of any floodwaters that may extend into areas adjacent to the landfill are expected to be less than 453 feet. No flooding of the landfill or the adjacent Crossroad property was observed in 1993 and 1995 during the 500- and 300-year flood events that occurred in these years.

2.1.6 Surface Water Drainage and Vegetation

Surface runoff from Area 1 ultimately flows north to a drainage ditch along the south side of the landfill access road, east to the drainage ditch on the southwest side of St. Charles Rock Road, and then north to a small pond (North Surface Water Body) located just north of the northwest corner of Area 2 (Figure 7). Runoff from Area 2 generally flows into an internal closed topographic depression within Area 2 (Figure 7). Some of the southern part of Area 2 drains into on-site drainage ditches that eventually route runoff to the drainage along the landfill access road and then to the drainage and pond (North Surface Water Body) along St. Charles Rock Road. During major storm events, a very small portion of Area 2 can potentially drain down the landfill berm onto the former Ford property.

Three types of plant communities were identified in Areas 1 and 2 during the RI. These include old field and hydrophilic plant communities identified in both Areas 1 and 2, and a forest plant community identified in Area 2 only. A fourth plant community, a maintained field community, was identified in areas adjacent to the landfill. The maintained field areas are subjected to mowing at frequency of at least once per year. No Federally-listed, threatened, endangered or sensitive species or communities are known to occur on the landfill or in the surrounding area.

2.2 Subsurface Conditions

This section provides brief descriptions of the geology and hydrogeology of the site and the nature and extent of contamination associated with Areas 1 and 2. Additional, more detailed information on the geology and hydrogeology is presented in the OU-1 and OU-2 RI reports (EMSI, 2000 and Herst & Associates, 2000). Additional information regarding the nature and extent of contamination associated with Areas 1 and 2 is presented in the OU-1 RI report (EMSI, 2000).

Comment [KR17]: For purposes of this SFS, this section might be more usefully devoted to characterizing groundwater conditions, as previously requested by EPA, which should entail a summary of the groundwater sampling data.

Comment [KR18]: In contradiction to this opening sentence, Section 2.2 does not provide information about the nature and extent of contamination in Areas 1 and 2.

2.2.1 Geology

The geology of the landfill area consists of Paleozoic age sedimentary rocks overlying Pre-Cambrian age igneous and metamorphic rocks (EMSI, 2000). The Paleozoic bedrock is overlain by unconsolidated alluvial and loess deposits of recent (Holocene) age (EMSI, 2000).

The uppermost bedrock units near the landfill consist of Mississippian age limestone and dolomite with inter-bedded shale and siltstone layers of the Kinderhookian, Osagean, and Meramecian Series. The Kinderhookian Series is an undifferentiated limestone, dolomitic limestone, shale and siltstone unit ranging in thickness from 0 to 122 feet in the St. Louis area. The Osagean Series consists of the Fern Glen Formation, a red limestone and shale, and the Burlington-Keokuk Formation, a cherty limestone. The Fern Glen Formation ranges in thickness from 0 to 105 feet and the Burlington-Keokuk Formation ranges from 0 to 240 feet thick in the St. Louis Area.

The Meramecian Series overlies the Osagean Series rocks. The Meramecian Series consists of several formations including the Warsaw Formation, the Salem Formation, the St. Louis Formation, and the St. Genevieve Formation. The St. Genevieve Formation is reportedly not present near the landfill (Golder, 1996).

Pennsylvanian-age Missourian, Desmoisian, and Atokan formations are present in some areas above the Mississippian-age rocks. The Pennsylvanian-age rocks consist primarily of shale, siltstone, and sandstone with silt and clay. These formations range in combined thickness from 0 to 375 feet in this area. The Atokan-Series Cheltenham Formation was identified as being present in the former landfill soil borrow area located to the southeast of the landfill.

The St. Louis area is part of the New Madrid Seismic Impact zone. There is no indication that any Holocene-age faults are present at the site. Extensive geologic mapping of the quarry walls in the area of the recently closed sanitary landfill performed as part of the OU-2 RI did not identify the presence of any faults in the bedrock units in that area.

Comment [KR19]: Please add citation to specific pages.

The bedrock formations are overlain by Holocene-age alluvial deposits associated with the Missouri River and upland loess and glacial till deposits of Pleistocene age. The alluvial deposits range in thickness from 0 to 150 ft (Herst & Associates, 2000). Loessial deposits are up to 100 ft thick (Herst & Associates, 2000). Glacial till deposits occur less frequently in the area of the site but where present occur in layers up to 55 ft thick (Herst & Associates, 2000). The loess is an aeolian (windblown) deposit consisting primarily of silt and clay. Relatively thin loess deposits were reported to be present near the eastern portion of the site (Herst & Associates, 2000). The alluvial deposits typically consist of fine-grained (clay and silt) overbank deposits overlying poorly sorted, coarse-grained (sand and gravel) channel deposits associated with historic flooding and river meanders of the Missouri River. The depth to bedrock and the thickness of the alluvial deposits increases to the west of the site where the thickness of alluvium (depth to bedrock) was reported to be 120 ft (Herst & Associates, 2000).

2.2.2 Hydrogeology

Isolated perched water was encountered at a few locations in Areas 1 and 2. Continuous groundwater is present in the unconsolidated alluvial deposits present beneath and outside of Areas 1 and 2 and in the bedrock formations located beneath the site. Detailed discussions of the hydrogeology of the perched water, alluvial groundwater and bedrock groundwater are presented in the OU-1 and OU-2 RI reports (EMSI, 2000 and Herst & Associates, 2000) and will not be repeated in their entirety in this report. A summary of pertinent information regarding the site hydrogeology is presented below.

2.2.2.1 Occurrences of Perched Water

Isolated occurrences of perched water were encountered during drilling of the RI soil borings. Perched water was encountered at shallow depths within the landfill debris in eight of the 60 RI soil borings. Perched water was encountered during the drilling of two of the 20 borings in Area 1 (WL-108 and WL-116) at depths of 12 feet in WL-108 and at 8 feet in WL-116. Perched water was encountered in six of the 40 borings in Area 2 (WL-208, WL-209, WL-210, WL-214, WL-226, WL-227 and WL-230). at depths of 6 feet in WL-215 and 4.5 feet in WL-240 in the northeastern portion of Area 2 and at 12 feet in WL-217 in the south-central portion of Area 2. Perched water was also encountered at depths of 21 and 23 feet respectively in borings WL-219 and WL-220 in the southwestern portion of Area 2 and at a depth of 31.5 feet in boring WL-231 in the northern portion of Area 2. Based on the depths that the perched water was encountered and the proximity of the various boreholes in which the perched water was encountered, McLaren/Hart (1996e) identified five distinct bodies of perched water in the landfill, one in Area 1 and four in Area 2 (Figure 11). Overall, the presence of perched water appeared to be very limited and isolated in nature, generally occurring in small unconnected pockets at depths varying from five to 30 feet below ground surface.

2.2.2.2 Bedrock and Alluvial Hydrogeology

Continuous groundwater is present in both the bedrock units and the unconsolidated materials. The major bedrock aquifers of the St. Louis area include the Cambrian-age Potosi Dolomite and the Ordovician-age Gasconade Dolomite, Rubidoux Formation and St. Peter Sandstone. The hydrogeology of these aquifers is discussed in the OU-1 and OU-2 RI reports (EMSI, 2000 and Herst & Associates, 2000).

Alluvial deposits of varying thickness are present beneath Areas 1 and 2. The landfill debris varies in thickness from 5 to 56 feet in Areas 1 and 2, with an average thickness of approximately 36 feet in Area 1 and approximately 30 feet in Area 2. The underlying alluvium increases in thickness from east to west beneath Area 1. The alluvial thickness beneath the southeastern portion of Area 1 is less than 5 feet (bottom elevation of 420 feet above mean sea level [AMSL]), while the thickness along the northwestern edge of Area 1 is approximately 80

feet (bottom elevation of 370 feet AMSL). The thickness of the alluvial deposits beneath Area 2 is fairly uniform at approximately 100 feet (bottom elevation of 335 feet AMSL).

Review of water level data obtained during the RI from monitoring wells located outside of the landfill footprint indicated that the depth to water outside of the landfill generally ranged from approximately 10 to 20 ft below ground surface (bgs), corresponding to elevations of approximately ### to ### feet MSL. Shallow depths to groundwater were observed in wells installed along St. Charles Rock Road and near the Earth City flood control basin. Water level measurements obtained during the RI from wells located within or adjacent to Areas 1 and 2, however, indicated that the depth to groundwater in these areas was at least 35-40 ft bgs and generally nearer to 50 ft bgs, corresponding to elevations of approximately ### to ### feet MSL. Consequently, groundwater was generally encountered in the underlying alluvium near or immediately below the base of the landfill debris in Areas 1 and 2.

Monthly groundwater levels measured in various landfill wells indicate that groundwater generally occurs only in the underlying alluvium at or below the base of the landfill materials with the exception of the localized perched water conditions encountered in isolated areas within the landfill. Groundwater elevations varied seasonally and were generally lowest during the fall and winter months (September through March) and highest during the spring and summer months (April through August).

The regional direction of groundwater flow is in a generally northerly direction within the Missouri River alluvial valley, parallel, or sub-parallel to the river alignment. The RI data indicate that only a very small amount of relief (less than one foot) exists in the water table surface beneath the landfill, making interpretations of the directions of groundwater flow based only on water level data difficult. Based on the water level data, the inferred direction of groundwater flow beneath Area 1 is generally to the south toward the formerly active landfill. This southerly direction of groundwater flow is due to ongoing leachate extraction from the formerly active landfill that removes approximately 200,000 gallons per day (Herst & Associates, 2000), resulting in convergent flow toward the formerly active landfill. Water level elevations beneath Area 2 displayed areal differences of less than one foot making a site-specific determination of the direction of the hydraulic gradient impossible. Groundwater flow beneath Area 2 is inferred to be to the west/northwest toward the Missouri River.

2.2.2.3 Water Supply Wells

No public water supply wells are present near the landfill. An inventory of private wells in the area of the landfill is presented in the RI report (EMSI, 2000). The results of this inventory indicated that the nearest private well reportedly used as a drinking water source is located one mile to the north of the landfill (Foth & Van Dyke, 1989). This well is the nearest downgradient well that may be used for drinking water purposes. Two additional wells that are not used for drinking water purposes are also located 5,100 ft to the northwest and 4,600 ft to north-northeast of the landfill (EMSI, 2000).

Comment [E20]: Not sure why this sentence and the next mention of NRC data were deleted.

Deleted: The 1988 NRC report states "The water table of the Missouri River floodplain is generally within 10 feet of the ground surface but at many points it is even shallower." (NRC, 1988).

Deleted: Although the RI data indicated that the depth to groundwater outside of the landfill footprint was consistent with the NRC interpretation, this was not the case for the depth of groundwater observed beneath the landfill deposits.

Deleted: the landfill area, within

Comment [KR21]: To provide a coherent, authoritative depiction to the reader, this section should reconcile why the RI found different depths to groundwater within and surrounding Areas 1 and 2 and should explain the implications, if any, for downward migration of groundwater flow.

An updated well inventory was prepared as part of the RI for OU-2 (Herst & Associates, 2005). This evaluation included an inventory of both registered and unregistered wells located within approximately five miles of the West Lake Landfill. The closest registered well is located approximately one mile northeast of the landfill. This well was reportedly drilled to a depth of 245 ft which indicates a bedrock completion. Regional groundwater flow in the vicinity of the landfill is to the northwest, towards the Missouri River. Accordingly, the nearest registered well is not downgradient of the landfill. The closest registered well that appears to be completed in alluvium is approximately 2.5 miles south (upgradient) of the landfill.

Fifteen unregistered wells were reported to exist within five miles of the West Lake Landfill (Herst & Associates, 2005). Field reconnaissance was performed to verify the reported locations of the unregistered wells. Based on the field reconnaissance, only one of the fifteen reported unregistered wells was verified as present and the resident at this location stated that the well is no longer used because the property is serviced by municipal water.

2.3 Nature and Extent of Contamination

This section of the SFS summarizes occurrences of radiological and non-radiological constituents detected in soil/waste, surface water and sediment, groundwater and air in and around Areas 1 and 2. Additional, more detailed information regarding the nature and extent of contamination is presented in the OU-1 RI report (EMSI, 2000). Additional discussion regarding occurrences of radiologically-impacted materials is presented in the next section (Section 3) of this report.

2.3.1 Radionuclide Occurrences

This section presents a summary of radionuclide occurrences in soil/waste, surface water and sediment, groundwater and air in Areas 1 and 2.

2.3.1.1 Radionuclide Occurrences in Soil/Waste

Radionuclides are present in lenses and layers that are dispersed throughout the landfill deposits in Area 1 and Area 2 (Figure 12). Radiological constituents occur in soil materials that are intermixed with and interspersed into the overall matrix of landfilled refuse, debris and fill materials and unimpacted soil and quarry spoils. In some portions of Areas 1 and 2, radiologically impacted materials are present at the surface; however, the majority of the radiological occurrences are present in the subsurface beneath these two areas.

In general, the primary radionuclides detected at levels above background concentrations at the West Lake Landfill are part of the uranium-238 and uranium-235 decay series. Thorium-232 and radium-224 isotopes from the thorium-232 decay series were also present above background levels but at a lesser frequency.

Comment [KR22]: EPA previously suggested the SFS contain a separate section that provided a consolidated, coherent, and authoritative description of the occurrence, nature and extent of radionuclides within the landfilled mass of OU1 and summarized the scope of and rationale for the RI in that context. It is not apparent that the SFS is better for now having separate and partial discussions of these matters in Sections 2 and 3, as drafted and submitted.

The discussions regarding the locations and extent of the radiologically impacted materials presented in the RI and summarized below were based in part on the concept of "reference levels". Reference levels were based upon the EPA "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings" as set forth in Title 40, Part 192, Sections 12 and 41, which indicate that "The concentration of radium-226 (or radium-228) in land averaged over any area of 100 square meters shall not exceed the background level by more than 5 pCi/g, averaged over the first 15 cm of soil below the surface, and 15 pCi/g, averaged over 15 cm thick layers of soil more than 15 cm below the surface." These levels were used in the RI evaluations solely as a point of reference to easily and consistently identify the radiologically impacted materials and assess their extent, and should not be construed as representing potential remediation standards.

2.3.1.1.1 Radiological Area 1

Radionuclides are present in surface soil (the upper 6 inches) at levels above 5 pCi/g above background over approximately 50,700 square feet (1.16 acres) of Area 1. Approximately 194,000 square feet (4.45 acres) of Area 1 have radionuclides present in the subsurface at depths ranging up to 7 feet, with localized intervals present to depths of 15 feet (Figure 12). The extent of subsurface occurrences of radionuclides exceeds and encompasses the extent of surficial occurrences of radionuclides in Area 1. Subsurface occurrences of radionuclides in Area 1 are present in soil material that is intermixed with the overall landfill matrix of refuse, debris and fill materials.

2.3.1.1.2 Radiological Area 2

Radionuclides are present in surface soil covering approximately 468,700 square feet (10.76 acres) of Area 2. An additional 17,200 square feet in the northeastern portion of Area 2 contains soil/sediment eroded from the surface of Area 2. Radionuclide impacted materials are present in the subsurface beneath approximately 817,000 square feet (18.76 acres) of Area 2 at depths of up to approximately 12 feet, with some localized deeper intervals at depths up to 50 ft bgs (Figure 12). The extent of subsurface occurrences of radionuclides exceeds and encompasses the extent of surficial occurrences of radionuclides in Area 1. Subsurface occurrences of radionuclides in Area 2 are present in soil material that is intermixed with the overall landfill matrix of refuse, debris, fill and non-impacted soil materials.

2.3.1.1.3 Radiological Occurrences on the Ford and Crossroad Properties

During the RI (EMSI, 2000), radionuclide occurrences in surface soil were identified in the southern portion of what at that time was property owned by Ford Motor Credit (referred to in the RI as the Ford property), located immediately to north and west of Area 2 (Figure 13). A portion of the Ford property was subsequently sold to Crossroad Properties, LLC (Crossroad). The remaining portion (the Buffer Zone) was subsequently sold to Rock Road Industries to provide a buffer between the landfill and the adjacent properties.

Reportedly, subsequent to completion of landfilling activities in Area 2, erosion of soil from the landfill berm occurred resulting in transport of radiologically impacted materials from Area 2 onto the adjacent Ford (now Buffer Zone and Crossroad) property (EMSI, 2000). The area was subsequently revegetated by natural processes such that no evidence of subsequent erosion or other failures were present. Occurrences of radionuclides were found in surficial (6 to 12 inches or less) soil at the toe and immediately adjacent to the landfill berm as a result of the historic erosion from Area 2. Based on an areal extent of 196,000 square feet and a presumed 6-inch thickness, the volume of radiologically impacted materials located on the Ford property was estimated to be 3,600 cubic yards.

In November 1999, the vegetation and surface soil on Crossroad Lot 2A2 and the Buffer Zone were scraped to a depth of approximately 2 to 6 inches. These activities were unauthorized and reportedly conducted by AAA Trailer, a neighboring property owner. The removed materials were piled in a berm along the southern boundary of the Buffer Zone, adjacent to the northwestern boundary of the West Lake Landfill. A small amount of removed materials was also placed in a small pile on the Crossroad property near the base of the landfill berm along the east side of Lot 2A1.

In February 2000, additional surface soil samples were collected from the disturbed area and submitted for laboratory testing. Only one sample (RC-02) obtained below and adjacent to the area of the former slope failure contained radionuclides (specifically thorium-230) above reference levels. The remainder of the samples contained either background levels of radionuclides or levels above background but below the reference levels. The results of the additional soil sampling indicated that most of the radiologically impacted soil that had previously been present on the Buffer Zone and Lot 2A2 of the Crossroad property had been removed and placed in the stockpiles. Evaluation of the soil sampling results obtained prior to and after the 1999 disturbance indicates that approximately one acre of the Buffer Zone may still contain some radionuclides above reference levels. Inspection of the area in May 2000 indicated that native vegetation had been re-established over both the disturbed area and the stockpiled materials. The presence of native vegetation over these materials was determined to be sufficient to prevent windblown or rainwater runoff of these materials.

A subsequent inspection of this area indicated that additional soil removal/regrading had been performed on the remaining portion of the Crossroad property and the adjacent Buffer Zone property by, or on the behalf of, AAA Trailer. These activities appear to have resulted in removal of the soil stockpiles created during the previous regrading activity conducted by AAA Trailer, removal of the remaining soil on Lot 2A2 and the Buffer Zone that had not been excavated by AAA Trailer during the 1999 regrading, and placement of gravel over Lot 2A2 and the Buffer Zone. According to AAA Trailer, all of the soil removed during the July 1999 grading work and the May 2003 gravel layer installation, was placed in the northeastern corner of the Buffer Zone (terra technologies, 2004). Trailers associated with AAA Trailer's operations have been parked in this area although use of the Buffer Zone for this purpose, which is owned by the Respondents, has not been authorized. As sampling has not been performed after the most recent grading work conducted by AAA Trailer (May 2003), the levels and extent of radionuclides, if any, that may remain in the soil in the Buffer Zone and Crossroad property are

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unknown at this time. Additional soil sampling to determine current conditions with respect to radionuclide occurrences in soil beneath the Crossroad property will be conducted as part of implementation of the selected remedy for this area.

2.3.1.2 Occurrences of Radionuclides in Perched Water/Landfill Seep

Perched water is present at isolated locations within the landfill materials in Areas 1 and 2. Radionuclides generally were not detected in the samples of perched water. The only radionuclides that were detected in perched water samples were at very low concentrations, approximately 1 to 2 pCi/l or less.

During the RI a seep was identified in the western portion of Area 2 (Figure 7). Seepage that occurred in this area flowed over the ground for a short distance prior to evaporating or infiltrating back into the underlying soil and waste. A sample of this leachate seep indicated that the radioisotopes present in the seep water were all below the Missouri State MCLs for drinking water supply systems. Based upon these results, the leachate seep was not considered to represent a significant pathway for radionuclide migration because the seep water did not migrate outside of the immediate area of the seep occurrence.

2.3.1.3 Occurrences of Radionuclides in Groundwater

Groundwater monitoring was performed during 1995, 1996 and 1997 as part of the RI and during 2004 in conjunction with the FS. The levels of radionuclides detected in groundwater beneath and adjacent to Areas 1 and 2 generally were below both background levels and the State of Missouri MCLs for drinking water systems. Total radium was detected in two OU-1 wells, D-3 and D-6 (Figures 14 and 15) at levels slightly greater than the MCL of 5 pCi/l for the total of Radium-226 and -228 isotopes. Dissolved radium in well D-6 also was slightly above the MCL (Figure 14). Well D-6 is located in the Buffer Zone immediately adjacent to the west side of Area 2. Neither total nor dissolved radium have ever been detected in shallow wells co-located with well D-6 or in wells located upgradient of well D-6. Based on all available data, the RI concluded that the source of the radium levels in well D-6 was possibly the result of cross-contamination: dragging down shallow impacted soil during drilling activities. Well D-3 is located in the western portion of Area 1. Radium was not detected in well D-3 at levels above the MCL during sampling performed for the RI; however, it was detected above the MCL during sampling performed in March and May of 2004 in conjunction with the FS. As radium was neither detected at levels above or even close to the MCL in wells (S-5 and I-4) completed at shallower depths at the same location as D-3 nor in any other wells in and around Area 1, the cause of the more recent reported occurrences of radium in well D-3 could not be identified. Finally, groundwater sampling performed for OU-2 detected total radium at levels above the MCL in well PZ-106-SS located in the southwestern portion of the site, and PZ-1201-SS located in the southern portion of the site (Figure 15). These wells are located on the margins of the

South Quarry Pit landfill and as such are hydraulically isolated from Areas 1 and 2 by the groundwater/leachate extraction from the Quarry Pits.

Groundwater monitoring performed during the RI and FS did not identify any wells containing uranium at levels close to or above the MCL. Uranium does possess a greater solubility than that of other radionuclides. Uranium isotopes (U-238 and U-234) have been detected in groundwater samples obtained from monitoring wells at the Site at levels of approximately 5 pCi/l or less. Uranium has also been detected in upgradient, background wells at levels up to approximately 2 pCi/l. The levels of uranium detected at the Site are below the 30 ug/l (approximately ## pCi/l for U-238 and ## pCi/l for U-234) federal and Missouri (10 CSR 60-4.060) MCL for uranium.

Based on the monitoring data obtained during the RI, leaching of radionuclides into groundwater and subsequent transport in groundwater to offsite areas was not considered to be a significant migration pathway. Although elevated levels of radionuclides have been detected in a few isolated wells completed within or adjacent to the OU-1 portions of the landfill, a plume or contiguous area of radionuclide occurrences in groundwater at concentrations above regulatory standards or risk-based levels is not present at the West Lake Landfill. The lack of a plume of radionuclide contamination in groundwater at the Site is consistent with the relatively low solubility of most radionuclides in water and their affinity to adsorb onto the soil matrix.

2.3.1.4 Radionuclide Occurrences in Surface Water and Sediment

Water samples were obtained during storm events to assess the potential for dissolved or suspended phase transport of site contaminants in precipitation runoff. Radionuclides were detected in some of the rainwater/runoff samples obtained as part of the RI. As no standards or health-based criteria exist for rainwater/runoff, the results of the analyses of these samples were compared to the Maximum Contaminant Levels (MCLs) for drinking water systems. One of the rainwater/runoff samples obtained from an onsite area contained radionuclides at levels slightly above the radium MCL. The analysis of this sample indicated that the total of radium-226 and -228 isotopes in the unfiltered sample was twice the MCL; however, the filtered sample contained radium levels far below the MCL. This indicates that the primary mechanism for rainwater runoff transport is transport of suspended sediment. None of the surface water samples (either dissolved or total fractions) collected from the nearest offsite surface water bodies (surface water retention and detention basins and flood control channels located adjacent to the Site) contained radionuclides at levels above MCLs.

Sediment samples were collected from various surface water diversion ditches, runoff control structures and erosional channels located onsite and offsite. Some of the sediment samples collected on-site contained levels of radionuclides above background. One sediment sample collected at the landfill boundary on the southern side of the access road contained radium-226 at a level of approximately 5 pCi/g above background. The levels of radionuclides detected in offsite sediment samples were generally near or just slightly above background levels.

Comment [KR23]: The activity for U-234 and U-238 will be very different when comparing them at the same mass concentration (such as the MCL). The appendix to the EPA *Soil Screening Guidance for Radionuclides* provides methodology for converting from mass to activity concentrations. <http://www.epa.gov/superfund/health/contaminants/radiation/pdfs/tbd-appendix-b-clean.pdf>

Deleted: 30

The potential for radionuclide transport in either the dissolved phase or as suspended sediment in rainwater runoff during average storm events is likely limited by the presence of the existing vegetative cover. Therefore, dissolved phase transport in rainwater runoff does not appear to be a significant potential pathway for radionuclide migration. Suspended sediment transport in rainwater runoff is a potential pathway for radionuclide migration within and adjacent to Areas 1 and 2; however, based on the results of the offsite sampling, it does not appear to be a significant pathway for offsite migration of radionuclides.

2.3.1.5 Radionuclide Occurrences in Air

Radon flux measurements obtained during the RI indicated that the radon flux levels from Areas 1 and 2 did not exceed the standard of 20 pCi/m²s (which is applied as an average to the entire area of interest) established pursuant to UMTRCA for radon emissions from residual radioactive materials from inactive uranium processing sites (40 CFR 192.02(b)). The presence of radon emissions from OU-1 indicates that these emissions may be a migration pathway of concern; however, testing performed during the RI indicated that the overall radon emissions from the landfill are below the standard. Mixing of radon with landfill gases and lateral migration from Area 1 or 2 through the landfill materials does not appear to be a migration pathway of concern based upon monitoring of radon concentrations in the landfill gas collection system.

Fugitive dust monitoring was conducted at one location in Area 1 and one location in Area 2 in accordance with the EPA approved RI/FS Work Plan (McLaren/Hart, 1994). Sampling for fugitive dust monitoring was performed at locations that contained some of the highest radionuclide concentrations in surface soil samples. Results of the fugitive dust monitoring indicated that although fugitive dust emissions may be a potential pathway at the landfill, the levels of radionuclides detected in the fugitive dust samples indicated that it is not a significant pathway for radionuclide migration from Areas 1 and 2 (EMSI, 2000). Fugitive dust is not considered a significant pathway for radionuclide migration under current conditions, primarily because the surfaces of Areas 1 and 2 are for the most part vegetated thereby reducing or preventing release of significant amounts fugitive dust.

2.3.2 Occurrences of non-radiological constituents

As part of the investigation of radiological occurrences in Areas 1 and 2, investigations of occurrences of non-radiological constituents were also performed. Occurrences of non-radiological constituents in Areas 1 and 2 are associated with the presence of solid waste materials disposed in the landfill and are not directly or indirectly related to the presence or occurrences of radiologically-impacted materials within the landfill.

2.3.2.1 Non-radiological Occurrences in Soil

Comment [KR24]: Because the SFS did not obtain any new sampling data and does not provide any new interpretations or significant clarifications about this subject, perhaps this addition to the SFS (in its current level of detail and organization) should be eliminated (with the exception of the information about groundwater quality conditions, which is important to understanding the respective monitoring plans for the remedial alternatives). A few sentences may be sufficient to summarize the RI and conveniently remind the reader about the results of the RI (other than ground water conditions). If the level of detail in this draft (about soil and air, for example) is necessary to understand one or more subsequent analyses in this SFS, then such rationale should be specifically described herein.

A complete summary of the results of the non-radiological analyses (both organic and inorganic) obtained from the surface and subsurface samples from Areas 1 and 2 is presented in the RI (EMSI, 2000). Additional detailed information is contained in the "Soil Boring/Surface Soil Investigation Report" (McLaren/Hart, 1996h).

2.3.2.1.1 Trace Metal Occurrences in Soil

Ten of the twelve trace metals analyzed for were detected in all or many of the soil samples. The most commonly detected trace metals were arsenic, chromium, copper, lead, nickel and zinc, which were detected in all or nearly all of the 37 samples analyzed for trace metals. Beryllium was detected in approximately half of the samples while cadmium and selenium were each detected in ten samples and mercury was detected in only four samples. Antimony was only detected in two samples and thallium was only detected in one sample. In addition, cyanide was only detected in two samples.

The highest trace metal levels were found in the following samples: WL-114 at 0-ft, WL-115 at 5-ft, WL-208 at 20-ft, WL-209 at 0-ft, and WL-210 at 0 ft. These samples contained two or three metals with concentrations greater than ten times the background levels. These included lead with four samples greater than ten times background, copper and nickel with three samples each greater than ten times background, chromium with two samples and arsenic and zinc with one sample each greater than ten times background.

2.3.2.1.2 Total Petroleum Hydrocarbons in Soil

TPH analyses were performed on the 43 soil samples for gasoline, diesel and motor oil range hydrocarbon compounds. Gasoline range hydrocarbons were detected in six, diesel range hydrocarbons in four, and motor oil range hydrocarbons in twenty of the 43 samples. The highest levels of petroleum hydrocarbons detected in any of the soil samples were found in the sample obtained from the 20-foot depth in boring WL-208 and the soil sample obtained from the 15-foot depth in boring WL-210.

2.3.2.1.3 Volatile Organic Compounds in Soil

Volatile organic compounds (VOCs) were detected in approximately three-quarters of the 43 soil samples. The primary VOCs detected were aromatic hydrocarbons (toluene, xylenes, etc.) and ketones (acetone and 4-methyl 2-pentanone) and isolated occurrences of methylene chloride. With the exception of a few samples, the concentrations of the individual VOCs detected were less than one ppm.

One sample (WL-208 at 20 ft) displayed high levels of VOCs compared to the results obtained from all of the other samples. This sample included the contents of a severely damaged 5-gallon container that was brought up with the augers during drilling operations. In addition to gasoline and motor oil range hydrocarbons, this sample contained stained soil with benzene at 120 ppm, toluene at 8,300 ppm, ethylbenzene at 300 ppm, xylenes at 2,300 ppm, acetone at 1,400 ppm, methylene chloride at 240 ppm, and 1,1-dichloroethane at 270 ppm.

The highest levels of VOCs in a soil sample were found in the sample obtained from boring WL-210 at 15 ft which contained toluene (140 ppm) and xylenes (166 ppm) along with lesser amounts of ethyl benzene (32 ppm) and 2-butanone (50 ppm). All of these results were estimated values. A high level of 1,4-dichlorobenzene was detected in the soil sample obtained from the 16-ft depth from boring WL-230. In general, the samples with the highest detected levels of VOCs (WL-115, WL-208, WL-210, WL-218, and WL-230) corresponded with samples that also contained high levels of petroleum hydrocarbons.

2.3.2.1.4 Semi-Volatile Organic Compounds in Soil Samples

Polynuclear aromatic hydrocarbons (PAHs) including naphthalene, 2-methylnaphthalene, pyrene, fluoranthene and phenanthrene were detected in some of the soil samples. The naphthalene compounds are often associated with occurrences of fuel, oil or other petroleum products, while the other PAH compounds detected may be associated with oil and fuel products but are also commonly found in conjunction with fires or fire debris as they can be a product of incomplete combustion.

Various phthalate esters (butyl benzyl phthalate, diethyl phthalate, di-n-butyl phthalate and di-n-octyl phthalate) were detected in a few of the samples. Bis(2-ethyl-hexyl) phthalate was detected in most of the soil samples. The detected concentrations of phthalate esters varied substantially but these compounds were generally detected at levels of less than one to approximately ten parts per million. In WL-115 butyl benzyl phthalate was detected at 180 ppm. In WL-208 where the 5-gallon container containing liquid was encountered during drilling and the removed soil stained, elevated butyl benzyl phthalate (5,100 ppm) and bis(2-ethylhexyl) phthalate (180 ppm) concentrations were detected.

Two phenol compounds (phenol and 4-methyl phenol) were also detected in a few of the soil samples with the highest levels found in the sample from the 15-ft depth of boring WL-210 and the 25-foot depth from boring WL-213. In addition, benzoic acid was also detected in three samples from Area 2 at levels from 0.15 to 0.79 ppm.

The compound 1,4-dichlorobenzene was detected in semi-volatile organic compound (SVOC) analysis of several of the soil samples. With the exception of the sample obtained from the 16-ft depth from boring WL-230, which contained approximately 530 ppm, only very low levels of 1,4-dichlorobenzene estimated to range from 0.062 to 0.14 ppm were detected in the soil samples.

2.3.2.1.5 Pesticides and Poly-Chlorinated Biphenyls in Soil

Pesticide compounds including 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, aldrin, dieldrin, endrin, beta-BHC, and Endosulfan I were detected at low levels, generally less than 0.01 ppm to less than 0.001 ppm (or one part per billion) in many of the soil samples. Three PCB Aroclors (1242, 1248, and 1254) were detected in Areas 1 and 2. In Area 1, three borings (WL-113, WL-114, and WL-115) detected PCBs at concentrations ranging from 0.033 to 2.6 ppm. In Area 2, PCB

Aroclors were detected in seven of eight borings (WL-208, WL-209, WL-210, WL-214, WL-226, WL-227, and WL-230) at concentrations ranging from 0.017 to 1.6 ppm; in the eighth boring (WL-218) PCBs were detected at a concentration of 18 ppm. The samples with the greatest number of pesticide and PCB occurrences included WL-113 at 45 ft, WL-115 at 5 ft, WL-218 at 25 ft, WL-227 at 40 ft, and WL-230 at 16 ft. The highest levels of PCBs were detected in the 25-ft depth sample from boring WL-218 that contained Aroclor 1248 at a concentration of 18 ppm. In all of the other borings in which PCBs were detected, the detected concentrations were approximately 2 ppm or less.

2.3.2.1.6 Asbestos Containing Materials in Soil/Waste

Identification of or testing for asbestos containing materials (ACM) was not included in the scope of the RI field investigations. Review of the soil boring logs does not indicate that pipe insulation, transite panels or other materials that may represent ACM were encountered during drilling; however, as stated above, identification of such materials was not part of the scope of the RI field investigations. Therefore, although previous investigations did not note the presence of ACM, no definitive information exists regarding the presence or locations where ACM may be present, if any, in Areas 1 and 2.

2.3.2.2 Non-Radiological Constituents Detected in Erosional Sediments

Non-radiological constituents detected in the erosional sediment samples obtained from Area 1 included trace metals, motor oil range petroleum hydrocarbons, SVOCs, and pesticides. Detected constituents included the following:

- SVOCs were detected in sediment samples from three of the four sampling locations (Weirs 1, 2, and 3). The detected concentrations were less than 0.2 ppm, except for bis(2-ethylhexyl)phthalate, which ranged as high as 5.8 ppm.
- Pesticides were detected in sediment samples from three of the four sampling locations (Weirs 1, 2, and 3). The detected concentrations ranged from 0.00034 to 0.00082 ppm.
- Motor oil petroleum hydrocarbons were detected in three of the four sediment samples (Weirs 1, 2, and 3). The detected range was 50 to 580 ppm with the highest concentration being detected in the sediment sample collected from Weir 2.
- Trace metal results were generally consistent in all four sediment samples. However, one sediment sample (Weir 2) indicated the presence of substantially higher copper (61 ppm) and nickel (130-ppm) concentrations.

Non-radiological constituents detected in the Area 2 erosional sediment samples included trace metals, motor oil range petroleum hydrocarbons, SVOCs, and pesticides. The detected compounds included the following:

- SVOCs were detected in one sediment sample (Weir 7). The detected concentrations ranged from 1.1 to 1.8 ppm.
- One pesticide (heptachlor epoxide) was detected in one of the sediment samples (Weir 5). The detected concentration was 0.0025 ppm.
- Motor oil petroleum hydrocarbons were detected in one of the five sediment samples (Weir 5). The detected concentration was 53 ppm.
- Trace metal results were generally consistent in all five sediment samples. However, one sediment sample (Weir 5) indicated the presence of substantially higher lead (60 ppm) and zinc (95-ppm) concentrations.

2.3.2.3 Non-radiological Occurrences in Surface Water

No trace metals or petroleum hydrocarbons were detected in any of the rainwater runoff samples. Non-radiological constituents detected in the Area 1 rainwater runoff samples included two VOCs (ethylbenzene and xylenes) and one SVOC (2,4-dimethylphenol). These constituents were detected in a runoff sample obtained along the north side of Area 1 near where a petroleum tank was located. The detected VOC concentrations ranged from an estimated value of 2.2 ug/l to 13 ug/l; the detected SVOC concentration was 75 ug/l. No other priority pollutant constituents of concern were detected in the four rainwater runoff samples obtained in Area 1. Review of analytical results for Area 2 rainwater runoff samples (Appendix D) indicates that none of the non-radiological constituents were present above detection limits.

Review of non-radiological analytical results for the North Surface Water Body (Appendix D) indicates that only one metal, lead, was detected in both the unfiltered and filtered samples at concentrations of 18 and 3.9 ug/l, respectively obtained from the surface water body (North Surface Water Body) located along St. Charles Rock Road near the north boundary of the landfill. No other non-radiological constituents were detected in the sample from the North Surface Water Body. No non-radiological constituents were detected in the Flood Control Channel samples.

2.3.2.4 Non-radiological Occurrences in Perched Water/Leachate Seep

Five metals were detected in the perched water samples (arsenic, chromium, mercury, nickel, and zinc) at concentrations below their respective MCLs. Two metals (lead and zinc) were detected in the Area 2 seep at concentrations below their respective MCLs.

Petroleum hydrocarbon compounds in the diesel and motor oil range were detected in the perched water samples. The detected concentrations ranged from 1.3 to 14 ppm. Petroleum hydrocarbons compounds in the diesel and motor oil range were also detected in the Area 2 seep sample at concentrations of 0.47 and 0.48 ppm, respectively.

Aromatic and halogenated VOCs were detected in the perched water samples at levels below their respective MCLs. Aromatic VOCs were also detected in the Area 2 seep sample at levels below their respective MCLs.

Thirteen SVOCs were detected in the perched water samples. Of these, six SVOCs were detected in at least two of the three perched water samples analyzed for SVOCs. The detected compounds included: benzoic acid (<75 to 810 ppb); naphthalene (30 to 63 ppb); phenol (<30 to 140 ppb); 4-methyl phenol (3.6 to 310 ppb); di-n-octyl phthalate (4.2 to 60 ppb); and bis(2-ethylhexyl) phthalate (30 to 260 ppb). Two SVOCs were detected in the Area 2 seep sample. These compounds were 1,4-dichlorobenzene (6.5 ppb) and 2,4-dimethylphenol (75 ppb).

Eight pesticides were detected in one or more of the perched water samples. The detected concentrations ranged from 0.015 to 0.18 ppb. Two PCB Aroclors were also detected in the unfiltered samples. PCB Aroclor 1242 was detected in the perched water sample obtained from boring (WL-231) at a concentration of 290 ppb. PCB Aroclor 1248 was detected in the perched water sample obtained from boring (WL-219) at a concentration of 3.4 ppb. No pesticides or Aroclor PCBs were detected in the Area 2 seep sample.

2.3.2.5 Non-Radiological Constituents in Groundwater

With the exception of the trace metals, which are naturally occurring, only isolated detections (i.e., these constituents were only detected in samples obtained from a single well or in a some instances in only a few wells) at low concentrations of non-radiological constituents were found in wells sampled in or near Areas 1 and 2. Being naturally occurring, trace metals were detected in a greater number of wells, particularly in the unfiltered samples which contained suspended sediment.

Arsenic was the most frequently detected trace metal and was found in approximately one-half of the wells sampled. Arsenic was detected at concentrations ranging from 10 to 420 micrograms per liter (ug/l). Occurrences of dissolved and total arsenic concentrations greater than its MCL (10 ug/l) were identified near Area 1 and Area 2 as well as near the closed demolition landfill and the inactive sanitary landfill (Figures 16 and 17).

Lead was detected in almost all unfiltered samples at concentrations ranging from 3.1 to 70 ppb. Lead occurrences above its MCL of 15 ug/l were found in wells located near both Area 1 and Area 2 (figure 18). Lead was not detected in any of the filtered water samples at concentrations above its MCL (Figure 19).

Benzene was detected at concentrations greater than its MCL (5 ug/l) in several wells located along the west side of the inactive landfill and near the northwest corner of Area 2. Benzene was not detected or not detected at concentrations greater than its MCL near other portions of Area 2, near Area 1 or anywhere else at the site (Figure 20).

Chlorobenzene was detected in well D-14 (170 ug/l) during the RI and in well D-85 (120 ug/l) during the additional sampling at levels above its MCL (100 ug/l). Chlorobenzene was detected in a few other wells near Area 1 and in single wells near the Closed Demolition Landfill and the Inactive Sanitary Landfill at concentrations below its MCL.

Due to the limited number of detections and the widespread nature of the locations where non-radiological contaminants have been detected, no discernable pattern of non-radiological occurrences in groundwater could be identified. The discontinuous nature of the occurrences of non-radiological contaminants in groundwater indicates that a plume or continuous area of groundwater contamination does not exist beneath the landfill.

2.3.2.6 Non-radiological Occurrences in Air

Methane gas measurements were performed as part of the RI field investigations. During the RI, methane levels ranging from less than 1% to as much as 45% were observed in the various boreholes drilled for the RI. The highest levels of methane were observed in boreholes drilled in Area 1 near the North Quarry Pit landfill. Lower levels of methane were observed in Area 2. Methane concentrations greater than 5% methane concentration by volume (the lower explosive limit or LEL for methane) were observed in both Area 1 and Area 2.

2.4 Baseline Risk Assessment

A Baseline Risk Assessment (Auxier & Associates, 2000) (BRA) was performed for Areas 1 and 2 and the adjacent Buffer Zone/Crossroad property (Auxier & Associates, 2000). The BRA included both a quantitative human health risk assessment and a screening level ecological risk assessment. The results of the BRA are summarized below.

2.4.1 Human Health Risk Assessment

The BRA identified three radionuclides (U-238, U-235, Th-232) and their associated daughter products (U-234, Th-230, Ra-226, Pb-210, and Pa-231) for a total of eight radiological Chemicals of Potential Concern (CoPCs) based on their relatively long half-lives. Based on a review of the site data and a toxicity screening, three trace metals (arsenic, lead, and uranium as a metal) and one polychlorinated biphenyl (Aroclor 1254) were also selected as CoPCs for the human health risk assessment. Based upon a comparison to EPA screening values, other trace metals and organic compounds detected in the soil samples obtained from Areas 1 and 2 were not selected as CoPCs because the maximum detected values of these constituents did not exceed the risk-based screening levels.

Several potential human receptors were identified and evaluated in the BRA including a groundskeeper currently working adjacent to Areas 1 and 2, a groundskeeper that may work on

Comment [KR25]: Because the SFS did not obtain any new sampling data and does not provide any new interpretations or significant clarifications about this subject, perhaps this addition to the SFS (in its current level of detail) should be eliminated. A few sentences may be sufficient to summarize these data, conveniently remind the reader about the results of the risk assessment, and lay a foundation for the remedial action objectives. If the level of detail in this draft is necessary to understand one or more subsequent analyses in this SFS, then such rationale should be specifically described herein.

Areas 1 and 2 in the future, and a current or future groundskeeper working offsite on the buffer zone/Crossroad properties. Potential receptors associated with possible parking, open storage or other uses of Areas 1 and 2 ancillary to potential future commercial/industrial uses in areas adjacent to Areas 1 and 2 were also evaluated. The potential pathways by which these receptors could potentially be exposed to contaminants present in Areas 1 and 2 included exposure to external radiation, inhalation of radon gas or dust containing radionuclides or other constituents, dermal contact with impacted materials, or incidental ingestion of soil containing radionuclides or other chemicals.

Although groundwater within the alluvial aquifer in the area of the Site may be potentially usable, potential exposure to radionuclides through consumption of groundwater is not considered to be a viable pathway of concern. The nearest drinking water well is a bedrock well located one mile to the northeast of the Site. Furthermore, all of the businesses and residences in the area use municipal drinking water supplies. Therefore, there currently is no use of shallow groundwater in the area of the Site and none is expected to occur in the future. In addition, as discussed above, groundwater monitoring to date has shown only isolated occurrences of chemical and radiological constituents at levels slightly above MCLs.

Table 2-1 presents a summary of the results of the risk assessment evaluations. Based upon an assessment of the carcinogenic potential and systemic toxic effects associated with each of the CoPCs, combined with the exposure assessment scenarios, potential risks were calculated for each potential receptor. These calculations indicated that the potential exposure to external radiation for the hypothetical groundskeeper that currently could work adjacent to Areas 1 and 2 resulted in a carcinogenic risk of 1×10^{-5} for Area 1 and 4×10^{-5} for Area 2. These calculated risks were within the generally acceptable risk range used by EPA of 10^{-4} to 10^{-6} . No adverse systemic (non-carcinogenic) effects to the groundskeeper were identified. The potential risks to a hypothetical groundskeeper working on the Buffer Zone/Crossroad properties adjacent to Area 2 resulted in a carcinogenic risk of 6×10^{-7} , which is also within the generally acceptable risk range used by EPA of 10^{-4} to 10^{-6} .

The potential risks to the future onsite groundskeeper working in Areas 1 and 2 were calculated at 6×10^{-5} for Area 1 and 2×10^{-4} for Area 2. The calculated risk for a future onsite groundskeeper working in Area 2 is at the upper end of or slightly exceeds the generally acceptable risk range used by EPA of 10^{-4} to 10^{-6} . As with the current exposure scenario, the calculated risk for a possible future exposure for a hypothetical offsite groundskeeper receptor (2×10^{-6}) was within EPA's accepted risk range.

Possible future uses of Areas 1 and 2 for parking lots, open storage, or employee recreation that may be ancillary to potential future commercial or industrial uses of portions of the landfill adjacent to Areas 1 and 2 were also addressed. The potential risks to a future user of a building that may be constructed adjacent to Area 1 or 2 (land use covenants prevent construction of a building on Area 1 or 2) were calculated at 1×10^{-5} for Area 1 and 4×10^{-5} for Area 2, both of which are within the accepted risk range of 10^{-4} to 10^{-6} used by EPA. The potential risks to future worker that may be involved in outdoor storage uses on Area 1 or 2 were calculated to be 1×10^{-4} for Area 1 and 4×10^{-4} for Area 2. The calculated risk for a future worker involved in

outdoor storage in Area 2 is at the upper end of or slightly exceeds the generally acceptable risk range used by EPA of 10^{-4} to 10^{-6} .

Non-radiological CoPCs are not projected to cause unacceptable risks under either the current or future exposure scenarios. Uncertainties associated with the human health risk assessment were addressed through the use of conservative assumptions likely resulting in an overestimate of the actual risks that may occur. Although the calculated potential risk levels, for the most part, are within the accepted risk range of 10^{-4} to 10^{-6} used by EPA, the calculated risks for some of the potential future exposure scenarios are at the upper end of, or slightly exceed the generally acceptable risk range used by EPA.

Consistent with the current and reasonably expected future uses of the property, industrial, commercial and recreational future uses were considered in the BRA. The calculated estimates of the potential risk were also based on exposure scenarios that were limited in part by existing restrictions on current and potential future land uses (institutional controls) at the Site. The evaluations of potential current and future risk were based on the assumption that the existing land use restrictions remain in place as these restrictions cannot be revoked or modified without the consent of EPA and MDNR. Consequently, the risk assessment reflects a No Further Action scenario (land use controls previously instituted) rather than a No Action scenario. Unrestricted use of the Site, including possible future residential use, was not evaluated as part of the BRA due to the industrial and landfill uses of the Site, the presence of land use covenants limiting future use, and requirements associated with post-closure regulations for solid waste landfills. Consequently, the BRA did not evaluate all possible exposure scenarios but rather included reasonably anticipated future uses.

As the surface of Areas 1 and 2 is not currently covered by a landfill cover meeting the requirements of the MDNR solid waste regulations, infiltration into and erosion of these areas poses a potential risk to human health or the environment. Based on the BRA evaluations, the presence of radionuclides in OU-1 poses risks to potential future onsite workers that are at the upper end of or slightly exceed the generally acceptable risk range used by EPA. In addition, the potential that the exposure duration and frequency for future onsite workers could be greater than those evaluated as part of the BRA suggests that risks to potential onsite workers could be greater than those calculated by the BRA. In addition, all possible future uses and exposures scenarios were not evaluated as part of the BRA. The presence of radionuclides and non-radiological contaminants in OU-1 would pose an unacceptable risk to public health if institutional controls and the physical integrity of the disposal areas are not maintained or if future uses change.

2.4.2 Ecological Risk Assessment

The BRA included a screening level ecological risk assessment (ERA). There is a significant amount of uncertainty associated with the actual potential for ecological impacts. A screening level risk assessment deals with such uncertainty by using highly conservative assumptions when estimating potential risks, thus intentionally overestimating the potential risk significantly,

sometimes by several orders of magnitude. Thus, while the screening level ERA indicates that a potential ecological risk may exist, the ERA also cautions that this does not mean that site-related chemicals are actually impacting ecological receptors.

After assessing the uncertainties, the ERA points out that Areas 1 and 2 currently support vegetative and animal communities with no observable impact to the plant communities. Vegetation in Areas 1 and 2 consists primarily of old field community (primarily grasses and herbaceous species with woody species present along the landfill berm in Area 2), interspersed with small areas of hydrophilic (herbaceous) vegetation within small depressions. Indications of the presence of deer, rabbits, coyotes and/or red foxes as well as various bird species were observed during the RI investigations. The ERA notes that the existing plant and animal communities are located within areas of landfill operations, and concludes that the ecosystems present at the landfill are the result of existing institutional controls and other limitations on land use within or adjacent to OU-1 that have allowed field succession to take place.

The screening level risk assessment concluded that ecological receptors may be at risk from exposure to chemical contaminants, especially metals, in Areas 1 and 2. Small burrowing animals may be at risk from exposure to radioactive materials in Area 2. Metals present in soils may adversely affect plants and soil invertebrates. However, both Areas 1 and 2 currently support vegetative and animal communities and there is no observable impact to the health of the plant communities.